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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/669,889	09/25/2003	Takatoshi Tsujimura	028567-0118	2240
2292	7590	04/17/2006	EXAMINER	
BIRCH STEWART KOLASCH & BIRCH PO BOX 747 FALLS CHURCH, VA 22040-0747			ROY, SIKHA	
			ART UNIT	PAPER NUMBER
			2879	

DATE MAILED: 04/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/669,889

Applicant(s)

TSUJIMURA ET AL.

Examiner

Sikha Roy

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 01 February 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 4-13, 19 and 20 is/are pending in the application.
- 4a) Of the above claim(s) 14-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 4-13, 19 and 20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 01 February 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

The Amendment, filed on February 1, 2006 has been entered and acknowledged by the Examiner.

Cancellation of claims 1-3 and addition of new claims 19,20 have been entered.

The new drawing of Fig. 9 has been entered and is approved by the Examiner.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 4-6 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over 6,727,645 to Tsujimura et al., and further in view of EP 0794569 to Endo et al.

Regarding claim 4 Tsujimura discloses (Fig. 2, 3E column 4 lines 42-63, column 5 lines 8-25) an organic light-emitting display device comprising a substrate 26, an emission control circuit with TFT 12 and 14 formed on the substrate 26, an insulating film 32 covering the control circuit and organic light-emitting device including a first electrode 34, a second electrode 36 formed on the insulating layer 32, a contact wiring structure for electrically connecting the emission control circuit and the organic light-emitting device. Tsujimura further teaches (Fig. 3E) the conductive wiring includes a first conductive layer (connection element) 61 for providing a good electrical connection between the driver TFT on the lower layer and cathode of OLED on the upper layer,

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composed of a conducting film same as of the first electrode, a second conductive layer made of the same material as the second electrode by extending the second electrode (Fig.2).

Claim 4 differs from Tsujimura in that Tsujimura does not exemplify a diamond-like carbon film between the first and second conductive layers in the contact wiring structure.

In the same field of endeavor Endo discloses (page 3 lines 20-26) use of fluorine-containing amorphous carbon which has high heat resistance as an interlayer insulating film in a multi-layer interconnection structure of a semiconductor device. Endo further teaches that this configuration reduces interconnecting delays owing to low specific dielectric constant of carbon film and provides fabrication of semiconductor device by a conventional conductive pattern forming process thereby reducing the fabrication cost.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to include diamond-like carbon (amorphous carbon) film between the first and second conductive layers, in the contact wiring connecting the OLED to the control circuit of Tsujimura as disclosed by Endo for reducing interconnecting delays owing to low specific dielectric constant of carbon film and providing fabrication of semiconductor device by a conventional conductive pattern forming process thereby reducing the fabrication cost.

Regarding claim 5 Tsujimura discloses (column 4 lines 51-54) the first electrode (anode) 34 includes aluminum.

Regarding claim 6 Endo discloses (page 3 lines 19,20) the diamond-like carbon (amorphous carbon) film contains fluorine.

Regarding claim 13 Tsujimura discloses (column 4 lines 3-24 Figs. 1,2) the emission control circuit of the organic LED device includes a driver TFT 12 for controlling current to the OLED device and a switching TFT 14 connected to the data line 22 and scan line 24 for controlling the driver TFT 12 and the contact wiring structure is electrically connected to the driver device by conducting line 30.

Claims 7, 8, 11 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over 6,727,645 to Tsujimura et al., and EP 0794569 to Endo et al. and further in view of U.S. Patent 6,833,667 to Hamano et al.

Referring to claim 7 Tsujimura discloses the organic light emitting device includes a light emitting layer 16 made of organic material generating light by charge injection from anode 34 and cathode 36. Tsujimura fails to disclose a diamond-like carbon film between the emitting layer and the first electrode.

Hamano in analogous art of organic electroluminescent device discloses (column 8 lines 18-43) a diamond-like (amorphous) carbon film formed between the first electrode (anode) and the light-emitting layer. Hamano further discloses that this amorphous carbon film exhibits high work function and it is better to use the amorphous carbon film in order to efficiently inject holes into the luminous layer and thus to increase the efficiency of the device.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to include the diamond-like (amorphous) carbon film between the first electrode and the light emitting layer of the light emitting device of Tsujimura and Ueno as taught by Hamano for efficiently injecting holes into the luminous layer and thus increasing the efficiency of the device.

Regarding claim 8 Hamano does not disclose the diamond-like carbon film between the first electrode and the light emitting layer containing fluorine.

However Endo discloses diamond-like (amorphous) carbon film containing fluorine has improved heat resistance, dielectric constant as low as 3 or lower and hence is conductive.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to substitute the diamond-like carbon film containing fluorine as taught by Endo for the diamond-like (amorphous) carbon film of Hamano for increasing conductivity and hence the efficiency of the device.

Regarding claims 11 and 12 Hamano discloses (column 10 lines 14-17) the second electrode (cathode) includes aluminum same as the first electrode material (column 7 line 58) and hence the work function of the material of the second electrode is same as that of the material of the first electrode.

Claims 9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over 6,727,645 to Tsujimura et al., EP 0794569 to Endo et al., U.S. Patent 6,833,667 to Hamano et al. and further in view of U.S. Patent 6,351,067 to Lee et al.

Regarding claim 9 Tsujimura, Endo and Hamano disclose the first electrode is an anode supplying holes to the emitting layer and the second electrode is a cathode supplying electrons to the light emitting layer. But Tsujimura, Endo and Hamano are silent about a diamond-like carbon layer between the emitting layer and the second electrode.

Lee in analogous art of organic EL device discloses a buffer layer of diamond-like carbon between the second electrode and the light emitting layer. Lee further teaches this configuration increases the electroluminescent efficiency of the device.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to include a diamond-like carbon layer between the emitting layer and the second electrode of Tsujimura, Endo and Hamano as suggested by Lee for increasing the electroluminescent efficiency of the device.

Regarding claim 10 Lee does not exemplify the diamond-like carbon film between the second electrode and light emitting layer containing fluorine.

However Endo discloses the diamond-like carbon film (amorphous carbon) supplemented or added with fluorine having relative dielectric constant of 3 or less contains inter-film water to an extremely low level. Hence this fluorine -containing amorphous carbon film can serve as barrier layer preventing any invasion of moisture.

Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to substitute the diamond-like carbon film of Lee with diamond-like carbon film containing fluorine as taught by Endo for preventing invasion of moisture into the organic light-emitting layer and thus enhancing the life of the device.

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film containing fluorine as taught by Endo for preventing invasion of moisture into the organic light-emitting layer and thus enhancing the life of the device.

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over 6,727,645 to Tsujimura et al., EP 0794569 to Endo et al., and further in view of U.S. Patent 6,882,094 to Dimitrijevic et al.

Regarding claim 19 Tsujimura and Endo are silent about the diamond like carbon film having SP3 and SP2 bond of carbon atoms.

Dimitrijevic in relevant art discloses (column 13 lines 1-12) diamond-like carbon are carbonaceous structures with both SP2 and SP3 hybridized bonds of carbon in amorphous form. Therefore it would have been obvious to one of ordinary skill in the art at the time of invention to specify the diamond-like carbon film of Tsujimura and Endo has inherently both SP2 and SP3 hybridized bonds of carbon in amorphous form as taught by Dimitrijevic .

Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over 6,727,645 to Tsujimura et al., EP 0794569 to Endo et al., and further in view of U.S. Patent 6,727,642 to Cho et al.

Regarding claim 20 Tsujimura and Endo do not exemplify the work function of the diamond like carbon film.

Cho in pertinent art discloses (column 6 lines 9-14) diamond-like carbon has a low work function of 0.1 –1 ev. Therefore it would have been obvious to one of ordinary



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skill in the art at the time of invention to specify the diamond-like carbon film of Tsujimura and Endo has same work function between 0.1-1 ev as that of DLC film as taught by Cho.

### ***Response to Arguments***

Applicant's arguments with respect to claim 4 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. U.S. Patent 5,942,769 to Grill et al. discloses amorphous fluorinated carbon film can suitably used as an insulator for spacing apart conductors in an interconnect structure. U.S. Patent 5,480,841 to Bickford et al. discloses wiring structure having dielectric core between two metal conductors.

### ***Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sikha Roy whose telephone number is (571) 272-2463. The examiner can normally be reached on Monday-Friday 8:00 a.m. – 4:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimeshkumar D. Patel can be reached on (571) 272-2457. The fax phone number for the organization is (571) 273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

*Sikha Roy*

Sikha Roy  
Patent Examiner  
Art Unit 2879